

Appl. No. 09/557,158
Reply to Office Action of June 4, 2003

REMARKS

Claims 1, 2 and 4-6 have been canceled. Claims 3 and 7-9 and new Claims 10-18 are active in the case. Reconsideration is respectfully requested.

Amendments to the Specification

The specification has been amended at several places to make minor linguistic changes to the text. None of these changes introduce new matter into the case.

Pages 14-15 of the text have been amended in several pages in order that the written description of the drawing more appropriately describe the features of the drawing. None of the amendments made introduce new matter into the case. Entry of the amendments into the record is respectfully requested.

Amendment to the Drawing

The replacement sheet of drawing is believed to contain those amendments which are necessary so that the sheet of drawing conform to the requirements of the Patent Office for the numbering of sheets of drawings. Entry of the replacement sheet is respectfully requested.

Claim Amendments

Claim 1 has been represented in the form of new Claim 10 while Claim 5 has been represented as new Claim 11. Claim 10 is of narrower scope than Claim 1 because it is limited to a catalyst of hexavalent chromium oxide as the essential oxidizing catalyst component. The subject matter of new Claims 12 and 13 is based upon the disclosure of the text at page 11, lines

11-16. The subject matter of Claims 14 and 15 is based upon the disclosure of the text of the paragraph bridging pages 9 and 10. The subject matter of Claims 16 and 18 is based upon the disclosure of the text on page 10 and the subject matter of Claim 17 is found on page 8, lines 9-17 of the text. Accordingly, entry of the claim amendments into the record is respectfully requested.

Invention

As defined by the present claims the present invention is directed to a process of producing synthesis gas by partially oxidizing or autothermally reforming a light hydrocarbon gas with a hexavalent chromium oxide catalyst, supported on an inert carrier and modified with an alkali or alkaline earth metal, as the light hydrocarbon contacts the catalyst and extracts oxygen therefrom thereby being partially reduced and the chromium oxide catalyst being capable of autonomously sustaining the catalytic partial oxidation reaction by means of redox cycles.

The invention is based on the discovery that the transfer of oxygen from hexavalent chromium oxide is slightly endothermic (9.5 kcal/mol), whereas for the production of synthesis gas from a light hydrocarbon by partial oxidation over the catalyst, the process is exothermic (from a minimum theoretical value of 8.5 kcal/mol to 20-30 kcal/mol). The overall reaction in the synthesis reactor therefore remains as exothermic. This stands in contrast to oxidation reactions to produce synthesis gas by the reduction of other metal oxides disclosed in the literature such as trivalent chromium oxide.

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Claim Rejection, 35 USC 103

Claims 1-8 stand rejected based on 35 USC 103 as obvious over Dickinson, U.S. Patent 2,602,809 in view of Davis et al., U.S. Patent 4,272,399. This ground of rejection is respectfully traversed.

The Dickinson patent represents prior art that is clearly relevant to the present invention because it discloses a catalytic method of producing synthesis gas by the partial oxidation of a solid carbonaceous material in the presence of a metal oxide catalyst such as magnetite or hematite with the subsequent re-oxidation of the partially reduced catalyst and recycling of the re-oxidized catalyst to the oxidation reactor. However, contrary to the statement made by the Examiner at page 4, lines 3-7 of the Office Action, the patent does **not** specifically teach hexavalent chromium oxide as an oxidation catalyst, although at column 9, lines 39-49 the patent does mention oxides of chromium, amongst a number of other metal oxides as possible catalyst materials for the partial oxidation reaction discussed in the patent. The failure of the patent to specifically mention CrO₃ as an oxidation catalyst is very significant in view of the discussion above directed to the discovery that the oxide of hexavalent chromium is unique among the oxides of chromium of being slightly endothermic in the transfer of oxygen from the oxide while the exothermicity of the oxidation reaction in which a light hydrocarbon is partially oxidized to synthesis gas over the CrO₃ catalyst is greater than the observed endothermicity. Thus, the CrO₃ catalyst of the invention has the two noteworthy advantages discussed in detail at page 6, line 23 to page 7, line 8 of the text that other metal oxide catalysts do not possess. Accordingly, the Dickinson patent fails to suggest the method as claimed in newly submitted Claim 10.

The deficiencies of Dickinson are neither overcome nor improved by the disclosure of

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Davis et al. Although Davis et al discloses the type of process disclosed by Dickinson for the partial oxidation of a light hydrocarbon, again there is no teaching or suggestion of the specific use of CrO₃ as the oxidation catalyst as opposed to any other metal oxide catalyst including chromium oxides other than CrO₃. The listing of suitable catalyst materials in the paragraph bridging columns 2 and 3 does not include a teaching or suggestion of CrO₃. Accordingly, the combined patents do not suggest the invention as claimed and withdrawal of the same is respectfully requested.

Claims 1-8 stand rejected based on 35 USC 103 as obvious over application Serial No. 09/810,561 in view of Dickinson, U.S. Patent 2,602,809. This ground of rejection is believed overcome by the filing of the attached copy of an assignment filed in the record of the copending application which clearly demonstrates that at the time of the present invention, the invention disclosed and claimed in copending application Serial No. 09/810,561 were commonly owned.
Accordingly, withdrawal of the rejection is respectfully requested.

Claims 1-8 stand provisionally rejected based on the judicially created doctrine of obviousness-type double patenting over Claims 1-25 of application Serial No. 09/810,561 in view of Dickinson, U.S. Patent 2,602,809. This ground of rejection is believed overcome by the filing of the enclosed terminal disclaimer which is directed to application Serial No. 09/810,561
Withdrawal of the rejection is respectfully requested.

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It is now believed that the application is in proper condition for allowance. Early notice to this effect is earnestly solicited.

Respectfully submitted,

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